

Patent Claims

SUB
A. 1.

5

1. An electro-optical liquid-crystal display comprising
a layer of liquid-crystal medium between two substrates with
alignment layers on inside surfaces of each of said substrates;

10

the liquid-crystal layer having a twist angle, from one substrate to the
other, of 110° - 360° ;

the liquid-crystal layer having a surface tilt angle of 2° - 20° ; and

each of said alignment layers having a thickness of 3 nm-150 nm.

15

2. A display according to claim 1, at least one of said alignment layers
has a layer thickness of 4 nm-60 nm.

20

3. A display according to claim 2, wherein the difference from 1 of the
steepness of the electric-optical characteristic line, represented by
the formula $V_{90}/V_{10}-1$, is half or less of the corresponding value of an
otherwise identical display in which the layer thicknesses of each of
the alignment layers is 100 nm.

25

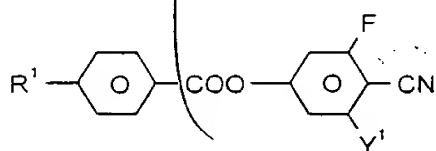
4. A display according to claim 1, wherein the steepness of the electro-
optical characteristic line V_{90}/V_{10} is 1.06 or less.

5. A display according to claim 1, wherein the threshold voltage (V_{10}) of
the display is 1.20 V or less.

30

6. A display according to claim 1, wherein said liquid-crystal medium
comprises one or more compound(s) of formula I

35

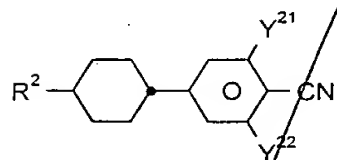


wherein

R¹ is alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms or alkenyloxy having 2 to 7 carbon atoms, and

Y¹ is H or F.

7. A display according to claim 1, wherein said liquid crystal medium comprises at least one compound of formula II



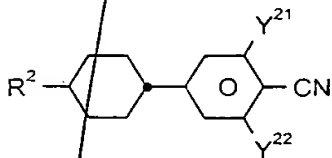
II

wherein

R² is alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms or alkenyloxy having 2 to 7 carbon atoms, and

Y²¹ and Y²² are each, independently, H or F.

8. A display according to claim 6, wherein said liquid crystal medium comprises at least one compound of formula II



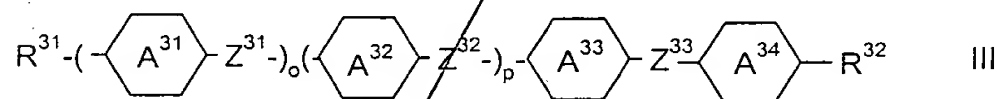
II

wherein

R^2 is alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms or alkenyloxy having 2 to 7 carbon atoms, and

Y^{21} and Y^{22} are each, independently, H or F.

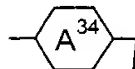
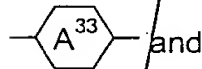
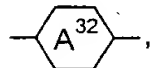
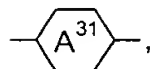
9. A display according to claim 6, wherein said liquid crystal medium comprises at least one compound of formula III



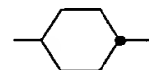
wherein

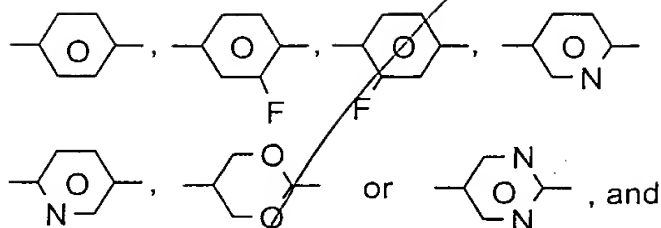
R^{31} and R^{32} are each, independently of one another, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, or alkenyloxy having 2 to 7 carbon atoms, and

Z^{31} , Z^{32} and Z^{33} are each, independently of one another, $-CH_2CH_2-$, $-CH=CH-$, $-COO-$ or a single bond,



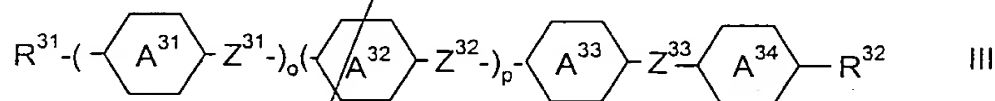
are each, independently of one another,





o and p, independently of one another, are 0 or 1.

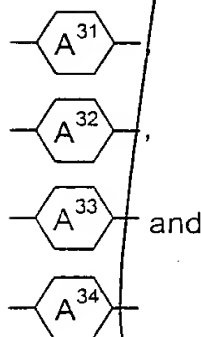
10. A display according to claim 7, wherein said liquid crystal medium comprises at least one compound of formula III



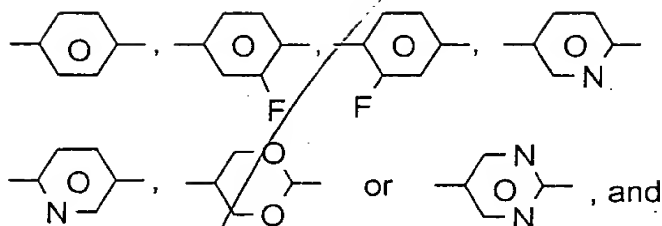
wherein

R^{31} and R^{32} are each, independently of one another, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl, having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, or alkenyloxy having 2 to 7 carbon atoms, and

Z^{31} , Z^{32} and Z^{33} are each, independently of one another, $-CH_2CH_2-$, $-CH=CH-$, $-COO-$ or a single bond,

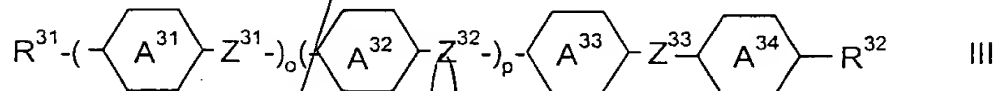


are each, independently of one another,



o and p, independently of one another, are 0 or 1.

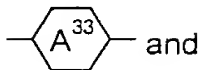
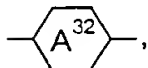
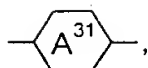
11. A display according to claim 8, wherein said liquid crystal medium comprises at least one compound of formula III



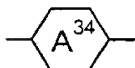
wherein

R^{31} and R^{32} are each, independently of one another, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkoxyalkyl, having 2 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, or alkenyloxy having 2 to 7 carbon atoms, and

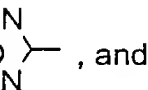
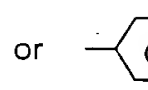
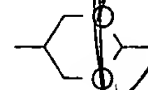
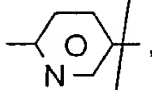
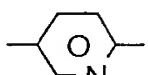
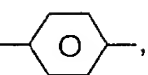
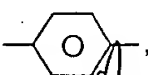
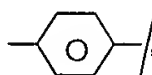
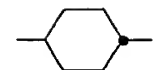
Z^{31} , Z^{32} and Z^{33} are each, independently of one another, $-CH_2CH_2-$, $-CH=CH-$, $-COO-$ or a single bond,



and



are each, independently of one another,



, and

o and p,

independently of one another, are 0 or 1.

12. In a method of displaying information using an electro-optical liquid-crystal display, the improvement wherein said display is one in accordance with claim 1.

Add
A2